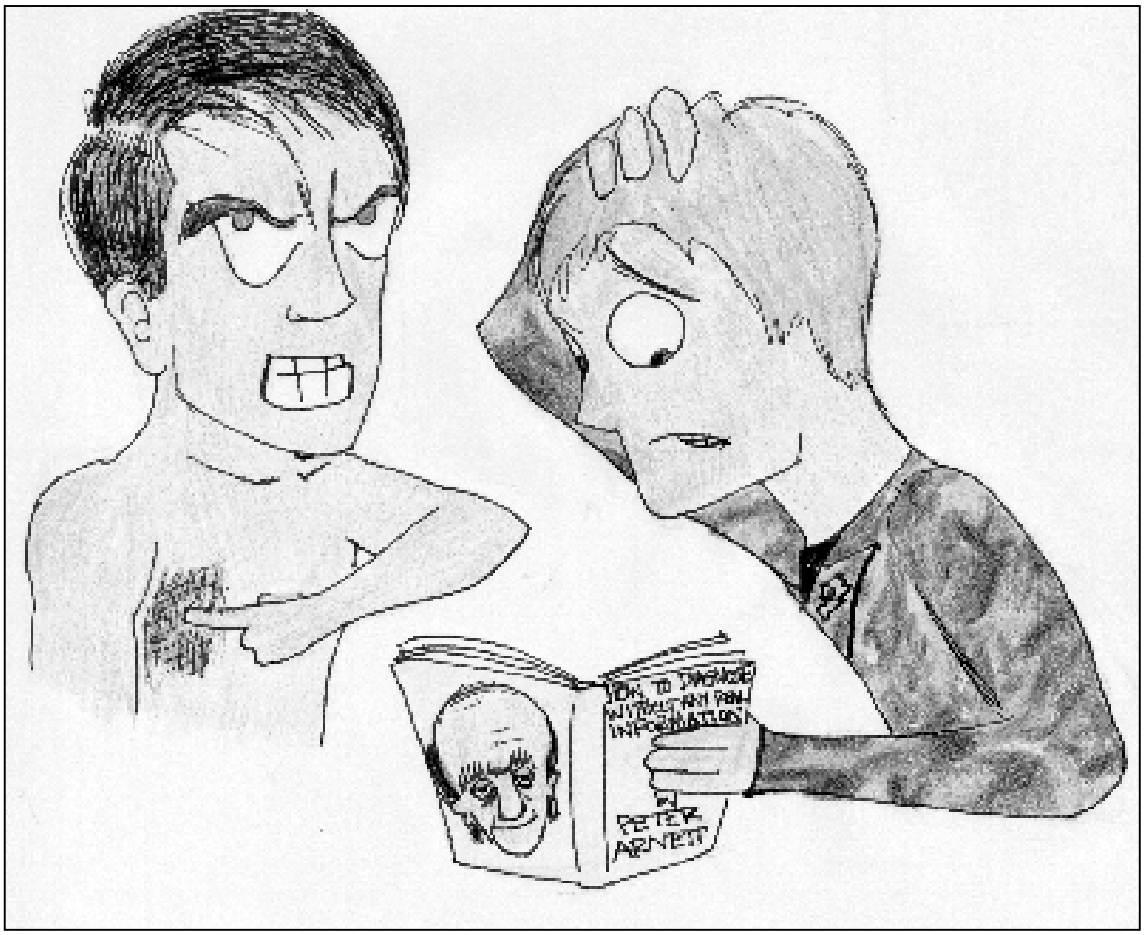
The Idiot's Guide to Teledermatology Imaging



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Tricare Region One
An Idiot-Proof Guide to:
Teledermatology Digital Photography and Imaging

Introduction:

This brief manual is meant to be an introductory "How to …" guide concerning techniques for digital imaging of patients with skin disease to create a "store and forward" teledermatology consult from a satellite clinic or a deployed unit. It is not meant to be comprehensive or serve as a substitute for the instruction books that were provided with your equipment. It is a guide, which provides an entry-level perspective presuming little if any experience in clinical photography. It will show you how to reliably capture the appropriate numbers and types of images that the teledermatologist requires to render a meaningful opinion. We are trying to serve a broad range of personnel who do teledermatology imaging. As such, some readers may find this manual as being overly simplistic; others may find it to be too full of detail. Your comments and suggestions concerning this manual are certainly welcome!

Equipment Required:

1. Minimum imaging and lighting requirements (expensive equipment is not necessary)

    -Light sources (camera's integral flash unit, Surgical lights, Gooseneck lights, Penlights etc.).
    -Digital camera capable of at least 600X800 lines per image in "millions of colors".
    -Lens capable of taking both longer distance views as well as close ups (i.e. 50-90 mm macro equivalent). A "fixed focus" type lens is not appropriate.
    -Intrinsic flash which can be set to "auto" or "off".

2. Know your gear.

Be sure that you know your camera and flash's functions and capability. Know your equipment! Be familiar with the manuals. In particular you need to make sure that:

-Your system (camera and flash if included) has sufficient battery power or external power.
-There is enough hard disk card storage remaining on the camera to complete the imaging session with your patient.
-Intrinsic flash is used most of the time for close ups (8-10 inches). Use obliquely oriented external lighting (see below) as primary source for close ups or as supplemental lighting for distance shots (e.g. full body views)

Identification of Images:

Each patient's images are a matter of clinical record and require ironclad identification. Begin each patient's imaging session with an identification photo that includes the patient's name (e.g. Smith, John A.), date of imaging session, FMP/SSN (e.g. 20-123-45-6789)

Clinical History:

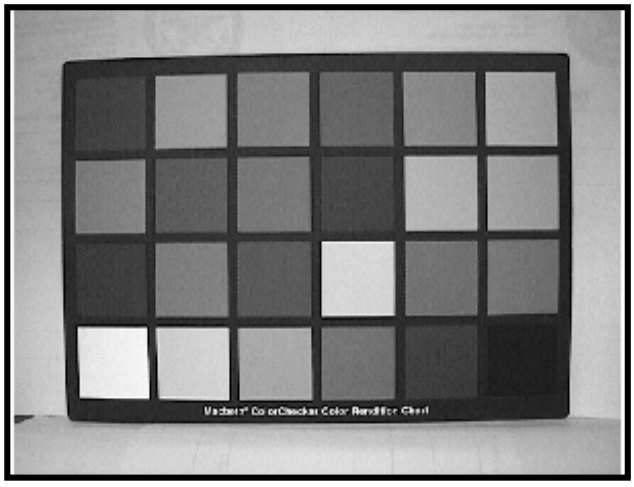
Make sure that the provider has given you adequate clinical information about the skin condition before you image the patient. A useful example is found at the end of this manual (History and Physical for Teledermatology Consults)

Background and Positioning:

1. Have your patient remove all medications, make-up, wristwatches, distracting objects or any clothing that interferes or distracts with the taking of the images. Be sure to have a "standby" in attendance when imaging "sensitive" areas (e.g. breasts and genitalia).

2. Position your patient in front of a reasonably clean, plain background such as a large gray surgical drape or bedsheet. Make sure that the background is neither too bright nor shiny, nor too dark either. Use a patient to camera distance that allows the inclusion of all of the appropriate areas. Make sure that your patient is comfortable!

3. Try to include either a reference color bar (e.g. MacBeth Color bar) or a greyscale reference card (see illustration below) in the images. The patient can hold it for you as you take the images. If not available, be sure to include in the viewfinder any very black object (e.g. black computer disk) and any very white object (e.g. a sheet of white bond paper).



MacBeth Color Bar

Areas to Image:

1. This is actually not as difficult as it may seem. You need to do the same thing as any healthcare provider looking at a patient with a skin condition. Resist the urge to immediately get very close to the condition. Be methodical in your approach. Start from a longer distance and then get as close and detailed as required for a particular condition.

2. Not every patient requires multiple views with detailed lighting techniques. However, it is important to figure out the sorts of views and level of detail that each patient needs. Here are two illustrative stories followed by their representative "real world" examples.

Supplemental Instruction For Imagers With Little Imaging Or Clinical Experience:

1. Imaging A Specific Spot or Solitary Area Of Interest (usually a growth or rash confined to only one body area such as the feet, hands etc.)

A. *Illustration of the Concept: The Alien and Pike's Peak*

Think of yourself as standing in a dimly lit room trying to show to a visiting (hopefully friendly) intergalactic hiker, the location and characteristics of Pike's Peak using an atlas which contains detailed topographical maps of the world. Your visitor has climbed a couple of easy hills elsewhere in our solar system. However, he now wants to know where Pike's peak is located on our planet and some of its characteristics. In short, he wants to know whether climbing it will be any different than the hills that he has experienced elsewhere.

The first thing you do is to show your companion the location of the United States on the world map. You then move to the United States map and show him the state of Colorado. You then turn to the map of the State of Colorado, and find Pike's Peak near Colorado Springs and outline it with your finger and show him the printed details of the altitude, steepness of the rocky terrain and the types of access roads and trails eventually leading to the summit.

Although your guest is polite, he makes it very clear to you that he can't really see these maps very well because he is viewing the map at an angle from across your desk. After apologizing to him for your thoughtlessness, you allow him to position his sophisticated compound eye directly over the map.

However, there is another problem. He tells you that he can't see the detail very well in your dimly lit room. You have two choices: go outside (if it is sunny) or shine some sort of light on the map. Since it is dark outside, you position your strong desklamp directly over the map. Unfortunately, the map is laminated in plastic and the reflection of your desklamp from the map obscures the detail. You realize your error and reposition the lamp at a 45-degree angle to the map. The glare disappears and the detail becomes crystal clear.

Your alien visitor is pleased and satisfied. He, picks up his rucksack, departs in peace and proceeds to Pike's Peak knowing just how different it is than the small little knolls that he has easily walked so far.

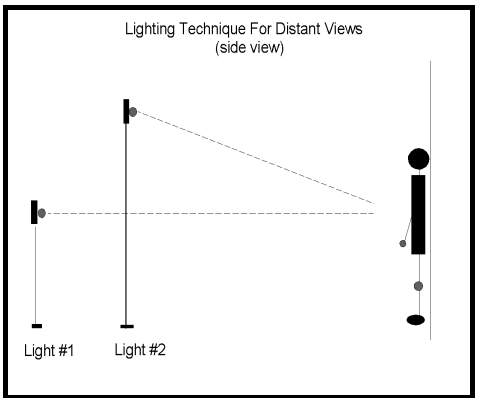
If you had initially pointed out the summit of Pike's Peak with your finger on the Colorado map, you would have easily confused your friendly extraterrestrial visitor as well as not told him all of the realities of the situation. He would not have been pleased with you. He needed some sense of reference and detail of topography in order to be aware of all relevant facts. You needed to use more than one view of the map atlas to properly communicate! In addition, you needed to position the map directly in front of his eye and provide adequate lighting. A happy alien is a friendly alien. Be sure to keep him happy. An unhappy alien is an unfriendly alien.

This is the very same thing that we are trying to do in teledermatology imaging. All of these principles apply to imaging diseases of the skin: the use of reference views, perspective, imaging directly perpendicular to the area of interest and the correct use of lighting are just as important to teledermatology.

B. *Clinical Example: Evaluating A Specific Lesion or Region of Interest* (E.g. mole on a back or rash on foot)

You should include the following views:

-Consider taking a view including the whole back for orientation (usually 8 feet). This is frequently not necessary if the skin problem is very well localized. Use the following suggested lighting techniques if you do not have an intrinsic flash (Illustrated below).

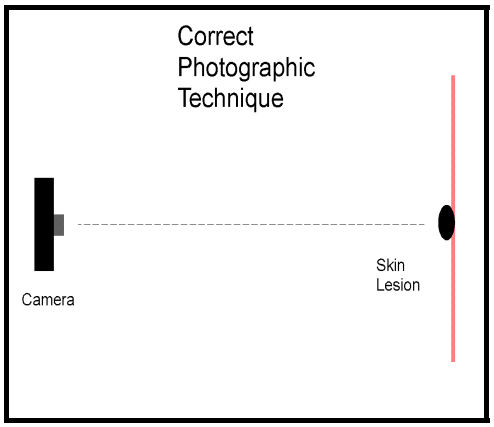


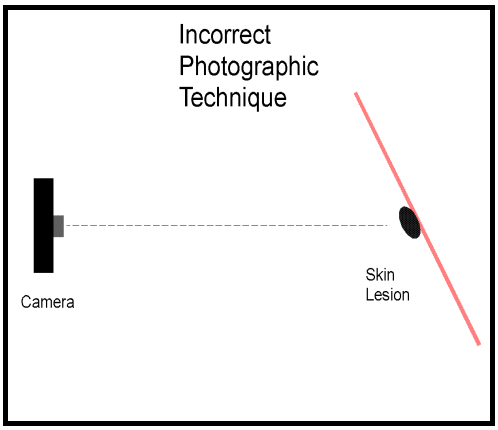
-A medium view (usually 3-5 feet) including some anatomic landmarks for orientation.

-At least one close up view in which the lesion occupies about one quarter of the viewfinder (usually 1 foot)

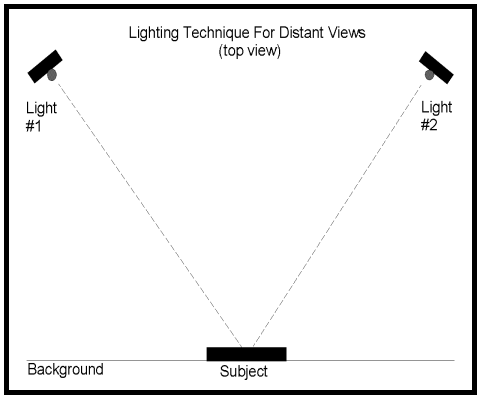
-Keep your camera directly perpendicular to what you're trying to photograph (see illustrations)

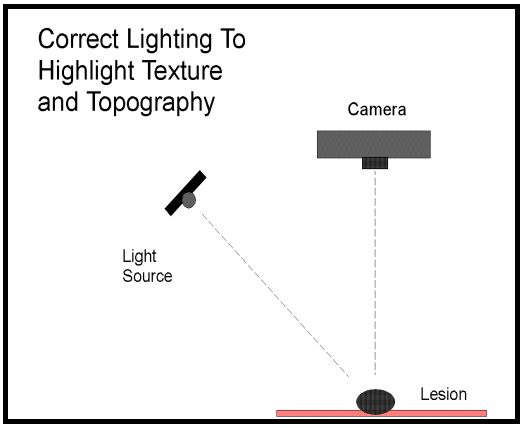
-If your camera's light source causes glare with close up views, use an oblique source of light positioned at a 45 degrees angle to the area you are trying to image





(see below).





2. <u>How To Image A Skin Condition Involving Multiple Sites</u> (usually widespread rash)

A. *Illustration of the Concept: The Alien and the Ostrich*

Our intrepid alien has returned after completing his trip and hike up Pike's Peak. Along the way he snapped some digital photos of a strange creature that he would like to identify. Not being well versed in either photography (or in earthling zoology for that matter) he took a total of 6 photos of this particular beast. He has just picked up his prints at the local Fotomat and wants to show them to you.

The first two prints reveal branch like structures that appeared very scaly (snake like in fact) on the close up. You immediately think that the creature may be some sort of reptile, possibly a snake. Maybe they represent legs?

The next two prints demonstrated a very long neck that seemed to be quite muscular on the close up. Hmmm ... Could this be a giraffe? They have long necks and legs. But wait a minute. While giraffes have very long necks, this does not seem to correspond to the previous two photos showing reptile like structures that may have been legs. You are now as confused as your intergalactic friend.

The next two prints illustrate a muscular body, which on the close up is covered with feathers!!!??? Nope, there aren't any wings seen on the distant view. Now you are really puzzled. What wingless-feathered creature could possibly have such strong legs?

You ask your friend for some historical information. It seems as if your amiable alien had seen the creature running very rapidly but not flying.

Eureka!!! Of course, it was an ostrich all along, but you had to put together all of the clues to identify it. Each clue by itself was not enough to identify the creature as an ostrich. However, putting all of the clues together, you were able to identify what it was.

Your intergalactic buddy nods both of his heads, thanks you for your brilliance and the opportunity to learn from you about earthling wildlife.

B. *Clinical Example: Evaluation of a Widespread Red Scaly Rash*

You need the following views:

-A long distance views (front and back) at 8-10 feet of distance to illustrate the total area of involvement

-A medium distance view to showing the worst areas of the rash. Do not be afraid to image the areas of the rash that the patient says are the most bothersome. Remember to ask about any involvement of palms, soles and genitalia.

-If one hand is affected, image the other one for comparison and check the soles as well to see if they also are involved. If they are, image them or at least examine them and make sure that they are not affected. The same thing applies if one foot is involved.

-If one elbow is affected, image the other one for comparison and check the knees as well to see if they are involved. If they are, image them or at least examine them and make sure that they are not affected. The same thing applies if a knee is involved.

-Close up views of the worst areas of the rash, preferably including areas that are minimally scratched by the patient.

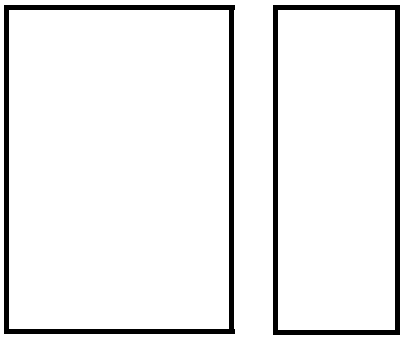
-Use a light held at a 45-degree angle to the surface of the skin to bring out the details of topography and surface texture of the involved skin. (See figure on page #5 above)

Suggested Standard Views for Dermatologic Imaging (As seen through a viewfinder)

1. Orientation/Full body, front and back (the so-called "anatomic position")

The patient standing with his arms out and palms facing forward is the standard anatomic position of reference.

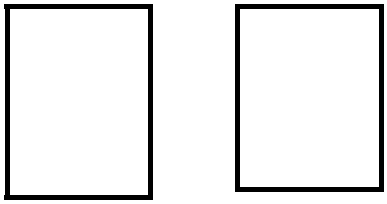
This image should be with the shirt off if the areas of interest are on the upper body and with the pants off if the lesions are on the lower body. The patient should be fully disrobed if the skin condition is all over the body.



A. Anteroposterior (AP) (illustrated)
B. Posteroanterior (PA) (illustrated)
C. Lateral (right illustrated)
D. Oblique (not illustrated)

2. Face

A. Anteroposterior (AP) view (illustrated)
B. Lateral view (left illustrated)
C. Oblique view (not illustrated)



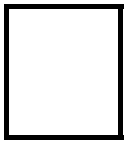
3. Mouth

When the lips are involved, have the patient gently open the mouth and pull the lips up or down.

A. Mouth open view
B. Lips pulled up/down view

4. Ear

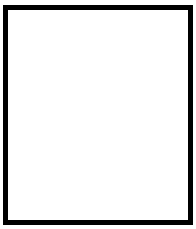
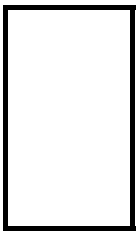
A. Lateral view (right illustrated)
B. Oblique view (not illustrated)



5. Scalp

If the patient has lightly colored or thin hair, scalp lesions will be more visible than on patients with darkly colored thick hair. Pull or pin hair away from the area of interest making sure that the hand does not obstruct the view.

6. Chest and Abdomen

Be sure to include nipple or navel as a reference point if needed Image the chest with the arms extended away from the sides (use position for anatomic position as above).

A. Anteroposterior (AP) view (illustrated)
B. Lateral view (right illustrated)
C. Oblique view (not illustrated)

7. Back

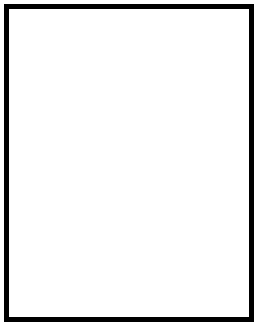
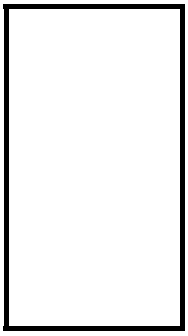
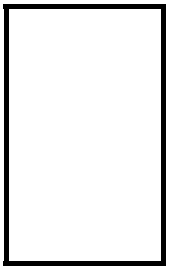



Image the back with the arms extended away from the sides (use posture for anatomic position as above). See chest views above.

A. Posteroanterior (PA) view (illustrated)
B. Lateral view (right illustrated)
C. Oblique view (not illustrated)

8. Axillae (armpit)



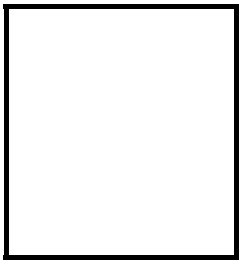
Raise the arm above the shoulder. Include nipple as anatomic reference. Beware of your light sources and/or flash creating shadows in the armpit.

9. Arms

If possible, extend the arm away from the body. Include nipple of chest for reference.

A. Dorsal view (PA) (illustrated)
B. Ventral view (AP) (illustrated)
C. Elbows (usually include knees if elbows are involved) (not illustrated)

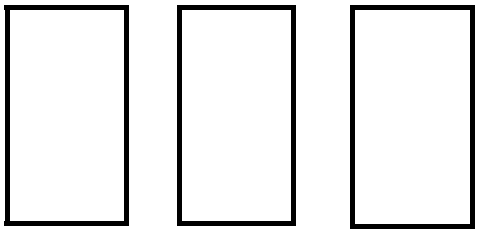
10. Hands/Wrists and Fingernails (single hand illustrated)



A. Dorsal view (also called PA, almost always include tops of feet if tops of hands are an area of interest) (illustrated)
B. Palmar view (also called AP) almost always include soles of feet if palms are an area of interest) (illustrated)
C. Web space view (not illustrated)
D. Fingertip/nail view (not illustrated)

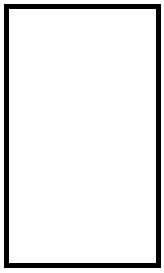
11. Legs

A. Anteroposterior (AP) view (illustrated)
B. Posteroanterior (PA) view (illustrated)
C. Lateral view (illustrated)
D. Oblique view (not illustrated)
E. Medial view of one leg (illustrated)
F. Lateral view of one leg (illustrated)



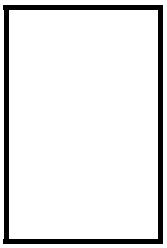
12. Feet/Ankles/Toenails

A. Dorsal view (Obtain views from straight above) (not illustrated)
B. Lateral views (not illustrated)
C. Medial views (not illustrated)
D. Sole views (Have the patient kneel or prop up the foot. Be sure to include the web spaces) (right illustrated)



13. Buttock/Groin and Genitals

A. Reference view (choose from AP, PA, Lateral, Oblique) (AP or PA illustrated)
B. Specific views (may require deflection of penis and scrotum or spreading of buttock cheeks) (illustrated)
C. Inguinal crease view (can visualize while patient is standing with one foot raised on a stool or chair) (not illustrated)



Comments on "Autofocus" Features:

While many digital cameras and other telemedicine imaging devices are equipped with an autofocusing device, one should not blindly trust them. Make sure that the area of interest is in the dead center of the viewfinder when the autofocus feature is engaged, otherwise it will automatically focus on an object that you may not be interested in.

Importance of Lighting:

The lighting technique employed can tremendously affect the image that you are taking. You should be concerned about highlighting texture and topography for your consultant as well as being concerned about over and under illumination of the skin. A poorly taken image can fool the consultant. Please review suggested lighting techniques illustrated at the beginning of this manual.

Teledermatology Consultation Preparation

1. Demographics:

Before taking a clinical history and images, you need to identify the patient as well as provide some other administrative information. Besides being required for medicolegal reasons, it will assist you in the administrative follow up of the patient and sometimes even provide some useful information for the teledermatology consultant. Sometimes this information will be available in patient's CHCS demographic profile, while on other occasions you must ask the patient directly. The minimum demographic elements are:

Name, FMP/SSN, date of birth, work and home telephone numbers, referring provider, providers phone number, date of consultation request, medications (including OTC) and medication allergies.

2. Clinical History:

When submitting cases, you need to provide good clinical history and well taken representative images of the patient's skin condition. All skin conditions can be classified into one of the following six categories. We have developed clinical templates for each of them: Acne/PFB, Alopecia, Pigmented Lesions, Non Pigmented growths, Rash and "Other". This last category "Other" is meant to be used only as a last resort when the patient's condition does not fit into one of the first five categories. Please use it sparingly if at all.

3. Clinical Images:

Providing good quality representative images of the patient's skin condition is just as important if not more important than a good clinical history. Please use the helpful tips concerning camera use and suggested lighting techniques in previous sections of this manual.

The views employed to image a patient with skin disease can be classified into three types:

A: Overview; long distance view taken to illustrate the distribution of a widespread or multifocal skin problem.
B: Regional; medium distance views designed to illustrate the worst or most representative sites or in the case of a skin growth, to provide some orientation as to where it is on the body.
C: Close Up; very detailed views designed to show the surface texture, topography, color and architecture of a skin growth or the detailed appearance of a "rash". As mentioned in previous sections, the use of oblique lighting and focus are crucial (and sometime difficult) for this type of image.

Below you will find some "real world" examples of how to use each of the six clinical templates as well as some "how to do it" examples of clinical imaging for each of them.

Acne/PFB

Demographics (as above)

Clinical History:

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other _____
-Duration: months, years, unknown, other _____
-Prior acne treatment, including OTC, duration of therapy
-Lesions on chest and back?
-Scarring?
-If female of childbearing potential, method of contraception
-For PFB patients, shaving history, previous treatments and results
-Provisional diagnosis

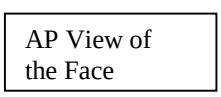
Images Suggested:

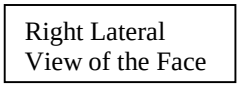
A. Not usually needed because the condition is usually localized to the face, neck, and trunk
B. Reference views of the face (e.g. full face or right and left profiles), view of upper back or chest (if necessary)
C. Images to demonstrate lesions that are characteristic for this particular patient (i.e. comedones, pustules, cysts, scarring etc)

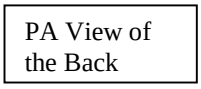
Sample images:

A. None required because the acne is confined to the face and upper back.

B. Regional Views: AP Face, Right Lateral Face, PA Back







C. Close Up Views: Right Lateral Face and PA Back (note effect of oblique external incandescent lighting to accentuate details of texture and topography

Close up, Right lateral face

Close up, PA view, upper back

Alopecia (hair loss)

Demographics: (as above)

Clinical History:

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other _____
-Hair loss has occurred over: days, months, years, other _____
-Hair loss is: localized, generalized, other _____
-Medications (including OTC) and duration: _____
-If female, menstrual history: regular, irregular, prepubertal, peri/post menopausal
-Within areas of hair loss (optional): scale, crusting, exudate, erythema, swelling, change in pigment etc.
-Provisional Diagnosis
-Miscellaneous Comments

Suggested Images:

A. Not needed if hair loss is confined to the scalp
B. Orientation views of the top of the head, side views and back views of the scalp to show the extent and location of the hair loss
C. Close up views of representative areas of hair loss. These views are needed to illustrate any inflammation, crust, scars (or lack thereof) to the consultant

Sample Images:

Lateral Views: Orientation and Close Up

Upper View: Orientation and Close Up

Non Pigmented Skin Lesion

Demographics (as above)

Clinical History:

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other ____
-Duration: months, years, unknown, other _____
-Location
-Size
-Prior treatment, biopsy or manipulation?
-Bleeding?
-Past history of skin cancer? Specify _____
-Family history of melanoma (parents, siblings, children)?
-Miscellaneous comments
-Provisional Diagnosis

Suggested Images:

A. Not needed unless these lesions are located on several regions of the body
B. Orientation views to illustrate the location of the lesion(s) (i.e. views of the face, portions of the back, chest, leg etc.)
C. Detailed views of the lesions itself. If the lesion has a nodular quality, consider "pinching" the lesion while taking this view in order to demonstrate this to the consultant

Sample Images:

A. Medium View

Note that you can tell the location of this lesion as well as its size

B. Close Up View

Note accentuation of surface texture, topography and borders

Other

Demographics: (as above)

Clinical History:

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other _____
-Duration: months, years, unknown, other _____
-Skin Symptoms: pruritus, pain, none, other _____
-Systemic symptoms?
-Location? Specify _____
-Previous therapy? Specify _____
-Known allergies? Specify _____

Suggested Images:

A. Take front, back and side views if the condition is widespread. Sometimes this view may not be necessary.
B. Use these views to illustrate the worst or most characteristic areas of the rash (e.g. elbows, knees, scalp in Psoriasis)
C. Detailed close ups of characteristic areas of the rash (i.e. to illustrate redness, pigment loss, crust, scale, surface detail)

Sample Images:

None provided for review. Photos will vary depending on the clinical condition.

Pigmented Lesion

Demographics (as above)

Clinical History:

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other _____
-Duration: months, years, unknown, other _____
-Size
-Change in color?
-Bleeding?
-Past history of skin cancer? Specify _____
-Family history of melanoma or "funny moles" (parents, siblings, children)?
-Miscellaneous comments
-Provisional Diagnosis

Suggested Images:

A. Not needed unless these lesions are located on several regions of the body
B. Orientation views to illustrate the location of the lesion(s) (i.e. views of the face, portions of the back, chest, leg etc.)
C. Detailed views of the lesions itself.

Sample Images:

A. Not Needed

B. Medium View

Note that you can appreciate the location, size and number of the lesions of concern

C. Close Up View (of one lesion illustrated in B. above)

Note illustration of surface, border and color irregularities

Rash

Demographics (as above)

Clinical History

-Reason for consultation: diagnosis, confirmation of diagnosis, recommendations for management, assumption of care, medical evaluation, hospitalization evaluation, disposition/duty status question, treatment recommendations, other _____
-Duration: months, years, unknown, other _____
-Distribution of rash (i.e. where is it on the body)
-Skin Symptoms: pruritus, pain, none, other _____
-Other skin symptoms _____
-Systemic Symptoms _____
-Medications prior to onset of this skin rash? Specify _____
-Possible contact exposure? Specify _____
-Others affected by this rash? Specify _____
-Past history of significant skin disease? Specify _____
-Medications used to treat this rash? Specify _____
-Occupation _____
-Hobbies _____
-Known allergies? Specify _____
-Relevant laboratory data
-Miscellaneous comments
-Provisional diagnosis

Suggested Images:

A. Take front, back and side views if the rash is all over the body
B. Use these views to illustrate the worst or most characteristic areas of the rash (e.g. elbows, knees, scalp in Psoriasis)
C. Detailed close ups of characteristic areas of the rash (i.e. to illustrate redness, pigment loss, crust, scale, surface detail)

Sample Images:

A. Distant views. (Anteroposterior and Posteroanterior needed for this rash which involved the upper chest, upper back and neck. Only Posteroanterior illustrated.

B. Medium Views (to show the most representative areas)

C. Close Up - This is a good representation of this reticulated, slightly scaly rash of Tinea Versicolor (oblique external lighting was employed to accentuate texture, topography and color)